Tennessee Valley Authority, Post Office Box 2000, Decatur, Alabama 35609-2000

November 24, 2008

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop: OWFN, P1-35
Washington, D. C. 20555-0001

10 CFR 50.73

Dear Sir:

TENNESSEE VALLEY AUTHORITY - BROWNS FERRY NUCLEAR PLANT (BFN) - UNIT 2 - DOCKET 50-260 - FACILITY OPERATING LICENSE DPR - 52 - LICENSEE EVENT REPORT (LER) 50-260/2008-001-00

The enclosed report provides details of an automatic turbine trip and reactor scram resulting from a failure of the design change process. TVA is reporting this in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in a manual or automatic actuation of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B) (i.e., Reactor Protection System including reactor scram or trip, and general containment isolation signals affecting containment isolation valves in more than one system). There are no commitments contained in this letter.

Sincerely,

R. G. West
Site Vice President, BFN
cc: See page 2

IE22
NRR

Enclosure
cc (Enclosure):

Ms. Eva A. Brown, Project Manager
U.S. Nuclear Regulatory Commission
(MS 08G9)
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852-2739

Eugene F. Guthrie, Branch Chief
U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth Street, SW, Suite 23T85
Atlanta, Georgia 30303-8931

NRC Resident Inspector
Browns Ferry Nuclear Plant
10833 Shaw Road
Athens, Alabama 35611-6970

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 08/31/2010

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE: Automatic Turbine Trip and Reactor Scram Resulting From a Failure of the Design Change Process

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									None	N/A
10	04	2008	2008	- 001 -	00	11	24	2008	FACILITY NAME: None	DOCKET NUMBER: N/A

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER *(Include Area Code)*
Steve Austin, Licensing Engineer	256-729-2070

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
N/A	N/A	N/A

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On October 4, 2008 at 2208 hours, Central Day Light Time (CDT) the Unit 2 reactor automatically scrammed following a turbine generator load reject signal. At approximately 2107 hours CDT, just prior to the reactor scram, operations noted the 500 kV Unit Station Service Transformer 2B tap changer operating excessively and the generator was experiencing field voltage, transfer voltage, and phase amperage swings. Operations decided to place the voltage regulator in the manual control mode in accordance with Operating Instruction, 2-OI-47, Turbine-Generator System. However, when Operations transferred the voltage regulator from the auto mode to the manual mode, Unit 2 received a turbine trip and subsequent automatic reactor scram. While placing the voltage regulator in the manual mode, contacts 7 and 8 on the Voltage Regulator Auto/Manual Transfer Relay (43A relay) failed to make-up; thus, causing the turbine to trip. The root cause of this event was a failure of the design change process. The process did not provide a prompt to consider relay contact wetting and signal threshold when selecting a relay for switching low energy control signals. The event was result of the installation of a relay in an application for which it was poorly suited. TVA replaced the 43A relay in main-generator voltage regulator circuit with a relay that is better suited for a low power application. TVA will revise the Technical Evaluation Considerations Checklist to address contact selection for relays installed in low energy circuits.

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NARRATIVE

I. PLANT CONDITION(S)

Prior to the event, Units 1, 2, and 3 were operating in Mode 1 at 100 percent thermal power (approximately 3458 megawatts thermal). Units 1 and 3 were unaffected by the event.

II. DESCRIPTION OF EVENT

A. Event:

On October 4, 2008 at 2208 hours, Central Day Light Time (CDT) the Unit 2 reactor automatically scrammed following a turbine generator load reject signal. At approximately 2107 hours CDT, just prior to the reactor scram, operations noted the 500 kV Unit Station Service Transformer (USST) [EL] 2B tap changer operating excessively and the generator was experiencing field voltage, transfer voltage, and phase amperage swings. Operations decided to place the voltage regulator in the manual control mode in accordance with Operating Instruction, 2-OI-47, Turbine-Generator System. However, when Operations transferred the voltage regulator from the auto mode to the manual mode, Unit 2 received a turbine trip and subsequent automatic reactor scram.

During the event, all automatic functions resulting from the scram occurred as expected. All control rods [AA] inserted. The primary containment isolation system (PCIS) [JE] isolations: Group 2 (residual heat removal (RHR) system [BO] shutdown cooling), Group 3 (reactor water cleanup (RWCU)) [CE], System Group 6 (ventilation), and Group 8 (traversing incore probe (TIP)) [IG] were received along with the auto start of the control room emergency ventilation (CREV) [VI] system and the three standby gas treatment (SGT) [BH] system trains. As a result of the low reactor water level and high reactor pressure, Operations briefly entered Emergency Operating Instruction, (2-EOI-001) Reactor Pressure Vessel Control.

Following verification that the 2-AOI-100-1, Reactor Scram, actions were completed the reactor mode switch was placed in shutdown. Operations reset the reactor scram by 2211 hours CDT. By approximately 2227 hours CDT, operations reset the PCIS actuations and secured the SGT and CREV systems.

TVA is submitting this report in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in a manual or automatic actuation of the systems listed in paragraph 10 CFR 50.73(a)(2)(iv)(B) (i.e., reactor protection system including reactor scram or trip, and general containment isolation signals affecting containment isolation valves in more than one system).

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

C. Dates and Approximate Times of Major Occurrences:

October 4, 2008 at 2208 hours CDT	Unit 2 received an automatic reactor scram.
October 5, 2008 at 0116 hours CDT	TVA made a four hour non-emergency report per 10 CFR 50.72(b)(2)(iv)(B) and an eight hour non-emergency report per 10 CFR 50.72(b)(3)(iv)(A).

D. Other Systems or Secondary Functions Affected

NARRATIVE

None.

E. Method of Discovery

The turbine trip and reactor scram were immediately apparent to the control room staff through numerous alarms and indications.

F. Operator Actions

Operations personnel responded to the event according to applicable plant procedures. The scram was uncomplicated. The operator actions taken in response to the scram were appropriate. These actions included the verification that the reactor had shutdown, the expected system isolations and indications had occurred, and subsequent restoration of these systems to normal pre-scram alignment.

G. Safety System Responses

The RPS logic responded to the turbine trip per design to initiate the reactor scram. All control rods inserted. The PCIS isolations Group 2 (RHR system shutdown cooling), Group 3 (RWCU system), Group 6 (ventilation), and Group 8 (TIP) isolation were received as expected, due to the lowering of the reactor water level, along with the auto start of the CREV system and the three SGT system trains. Emergency core cooling system actuation was not required.

III. CAUSE OF THE EVENT

A. Immediate Cause

During the performance of 2-OI-47, contacts 7 and 8 on the Voltage Regulator Auto/Manual Transfer Relay (43A relay) [RLY] failed to make-up when transferring the voltage regulator from automatic to manual control.

B. Root Cause

The root cause of this event was a failure of the design change process. The process did not provide a prompt to consider contact wetting and signal threshold when selecting a relay to switch low energy control signals. This resulted in a General Electric (GE) model HFA relay, with poor contact material for the application, installed in a low energy control circuit. The signal switched by contacts 7 and 8 of the 43A relay was only of sufficient power to switch semiconductor controlled rectifiers. The event was result of the installation of a relay in an application for which it was poorly suited.

C. Contributing Factors

None.

IV. ANALYSIS OF THE EVENT

TVA analyzed the failed relay and the preliminary results indicate intermittent high contact resistance.[1] The GE HFA relay is designed with silver alloy contacts rated for up to 250 VDC or 575 VAC and up to 30 amp current. The application literature does not provide a minimum voltage

[1] If the final analysis results affect the root cause, TVA will submit a revised LER.

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or current threshold and there are no published values or any recommendations for minimum voltage and current required to assure contact connections.

Silver alloy relay contacts used in low energy applications will oxidize because of the absence of contact sparking from the typical relay contact making and breaking functions. The sparking of the contact surfaces promotes a self-cleaning mechanism that reduces the tarnish buildup on the contact surfaces. TVA has determined the GE HFA relay was not suitable for the application which it was being used, low energy switching.

V. ASSESSMENT OF SAFETY CONSEQUENCES

The Unit 2 main turbine tripped on main generator backup relay [EL] operation resulting in a Unit 2 high side breaker trip and subsequent reactor scram on turbine control valve fast closure. The safety consequences of this event were not significant. All safety systems operated as required. PCIS groups 2, 3, 6, and 8 isolations were as expected. Operator actions were appropriate and consistent with plant procedures. Although the Emergency Core Cooling Systems were available, none were required. Reactor water level lowered to level 3, but remained above level 2; therefore, high pressure coolant injection [BJ] and reactor core isolation injection [BN] systems did not actuate. No main steam relief valves [SB] actuated. The turbine bypass valves [JI] maintained reactor pressure. The main condenser remained available for heat rejection. Reactor water level was recovered and maintained by the reactor feed water [SJ] and condensate [SG] systems. Therefore, TVA concludes that the event did not affect the health and safety of the public.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

Operations personnel placed the reactor in a stable condition in accordance with plant procedures.

B. Corrective Actions to Prevent Recurrence [2]

1. TVA replaced the 43A relay in main-generator voltage regulator circuit with a relay that is better suited for a low energy application.
2. TVA will revise the Technical Evaluation Considerations Checklist to address contact selection for relays installed in low energy circuits.

VII. ADDITIONAL INFORMATION

A. Failed Components

None.

B. Previous LERs on Similar Events

LER 260-2007-001 discussed a similar turbine trip followed by a reactor scram. In the previous event, the 43A relay had reached the end of its life. The corrective action from that event, which included replacing the relay, would not have prevented the event discussed in this LER.

C. Additional Information

[2] TVA does not consider these corrective actions as regulatory requirements. TVA will track the completion of these actions in the Corrective Action Program.

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Corrective action document PER 153987.

D. Safety System Functional Failure Consideration:

This event is not a safety system functional failure in accordance with NEI 99-02.

E. Loss of Normal Heat Removal Consideration:

The condenser remained available, providing a normal heat removal path following the reactor scram. Accordingly, this event did not result in a scram with a loss of normal heat removal as defined in NEI 99-02.

VIII. COMMITMENTS

None.